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LOCKHEED MARTIN



FILLER WIRE DEVELOPMENT FOR 2195 ALUMINUM-LITHIUM

**NASA RESEARCH ANNOUNCEMENT
CONTRACT NAS8-39929
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FILLER WIRE DEVELOPMENT FOR 2195 ALUMINUM-LITHIUM

SUMMARY

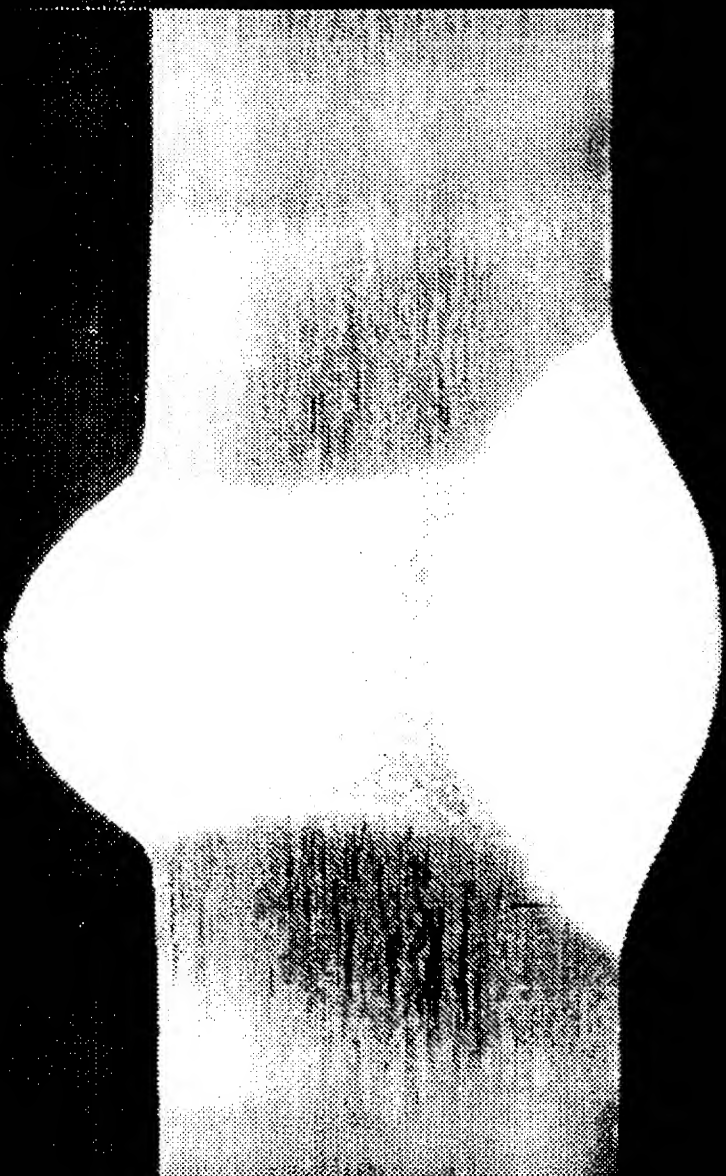
- INTRODUCTION
- OBJECTIVE
- APPROACH
- FILLER WIRE CHEMISTRY FORMULATION
- WELD EVALUATION
- DOWNSELECT
- DOWNSELECT WELD EVALUATION
- CONCLUSIONS

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FILLER WIRE DEVELOPMENT FOR 2195 ALUMINUM-LITHIUM

INTRODUCTION



0.320" t 2195 PLATE-TO-2195 PLATE ER2319



FILLER WIRE DEVELOPMENT FOR 2195 ALUMINUM-LITHIUM

OBJECTIVE

IDENTIFY AN Al-Cu BASED FILLER WIRE CHEMISTRY WHICH REDUCES WELD CRACK SUSCEPTIBILITY IN 2195 ALUMINUM-LITHIUM WELDS AND REPAIR WELDS ALONG WITH PROVIDING ADEQUATE MECHANICAL PROPERTIES.



FILLER WIRE DEVELOPMENT FOR 2195 ALUMINUM-LITHIUM

APPROACH

AUTOMATED
VPPA WELDING

FILLER WIRE FORMULATION
(14) CHEMISTRIES

MANUAL GTA
REPAIR WELDING

MANUAL GTA
TACK WELDING

FILLER WIRE CHEMISTRY DOWNSELECT
(3) CHEMISTRIES

AUTOMATED
VPPA WELDING

MANUAL GTA
REPAIR WELDING

FILLER WIRE CHEMISTRY RECOMMENDATION

FILLER WIRE DEVELOPMENT FOR 2195 ALUMINUM-LITHIUM

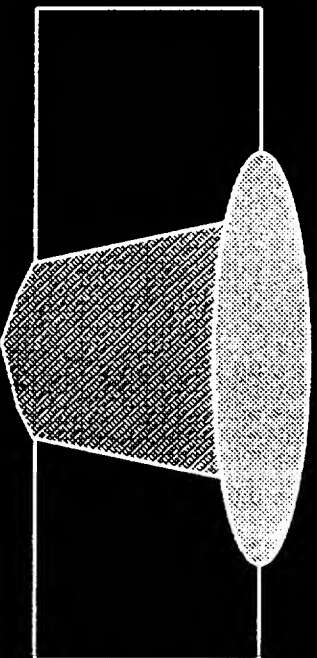
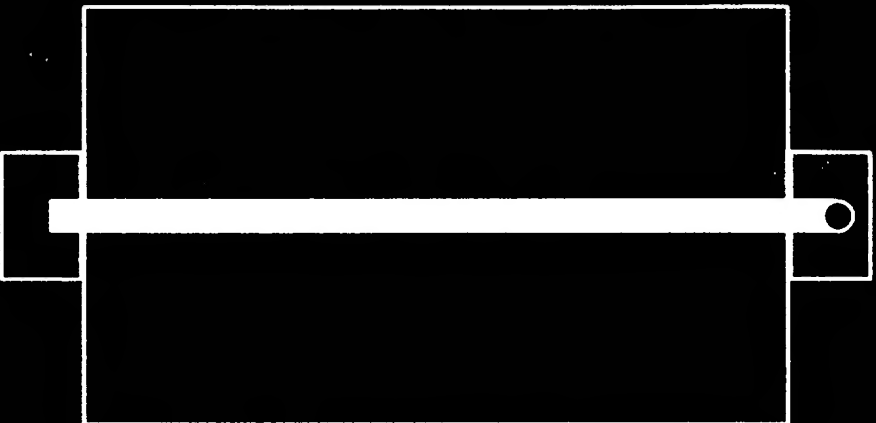
FILLER WIRE CHEMISTRIES

- (8) DOE CHEMISTRIES Cu, Li, Mg, Ag, Zn, Mn, V, Ti, Zr
- 2195 CHEMISTRY
- (5) 2319 VARIANT CHEMISTRIES Cu, Sc, Zr

FILLER WIRE DEVELOPMENT FOR 2195 ALUMINUM-LITHIUM WELDING

- AUTOMATED VPPA WELDING
- MANUAL GTA REPAIR WELDING
- MANUAL GTA TACK WELDING

FILLER WIRE DEVELOPMENT FOR 2195 ALUMINUM-LITHIUM VPPA WELDING

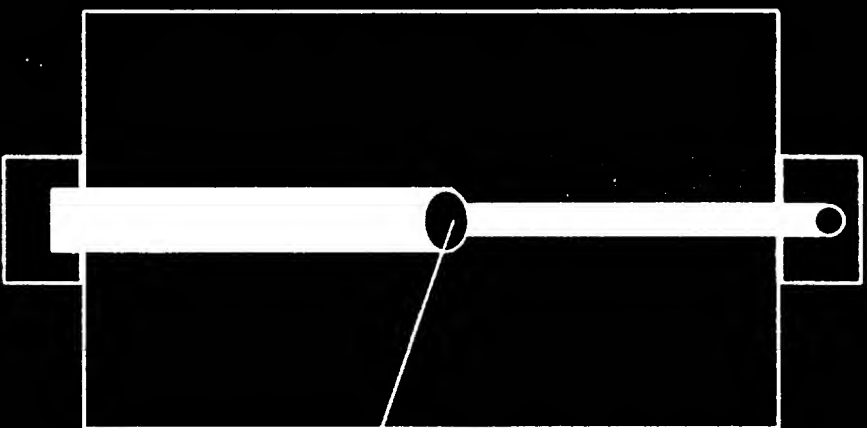


- (2) 16" LONG TEST PANELS WELDED
 - (3) RT AS-WELDED TENSILES
 - (3) RT SHAVED TENSILES
 - (2) RT J1c CENTERLINE
 - (2) RT J1c FUSION LINE
 - (3) SCC
 - (6) MET. SAMPLES

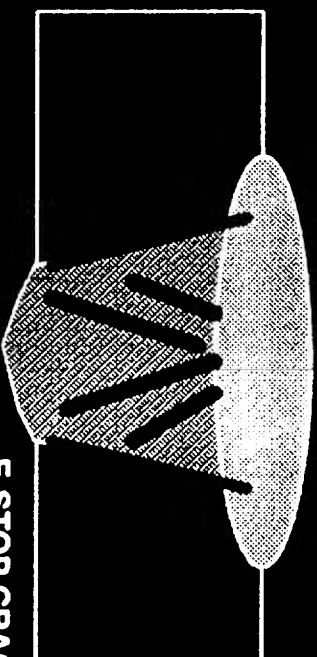
0.320"t 2195 PLATE-TO-2195 PLATE

FILLER WIRE DEVELOPMENT FOR 2195 ALUMINUM-LITHIUM

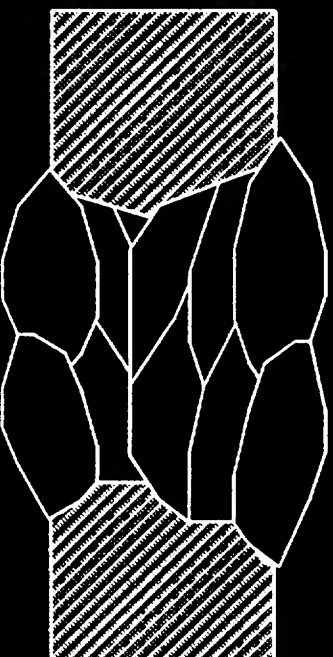
MANUAL GTA REPAIR WELDING



VPPA WELD
COVER PASS
WELD
E-STOP



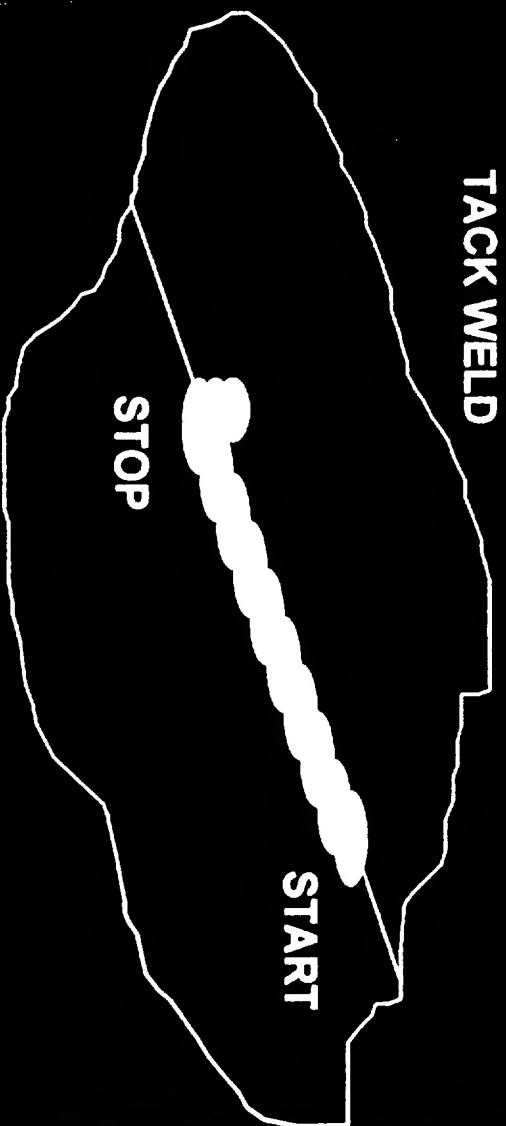
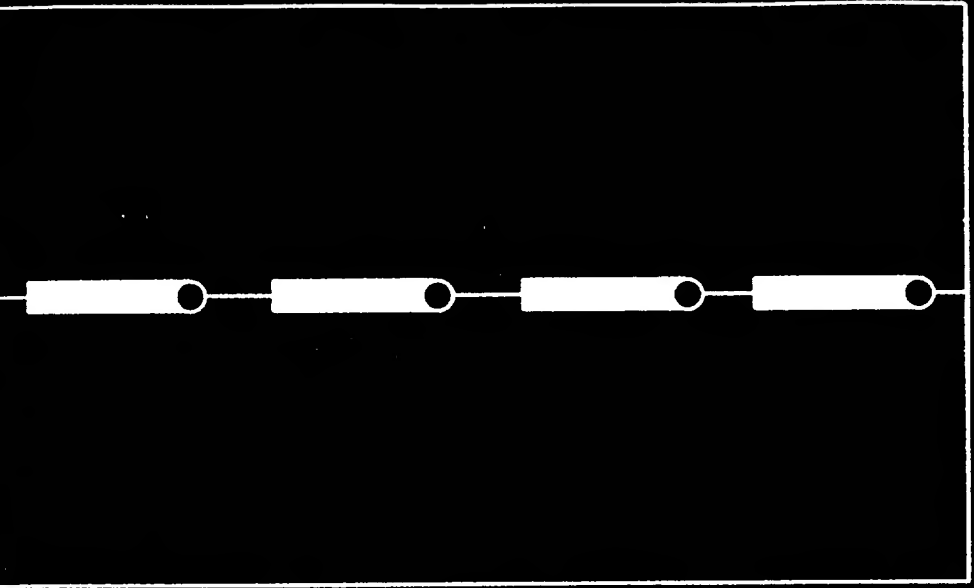
E-STOP CRACKING



TWO SIDED REPAIR WELD

0.320"t 2195 PLATE-TO-2195 PLATE

FILLER WIRE DEVELOPMENT FOR 2195 ALUMINUM-LITHIUM --- **MANUAL GTA TACK WELDING**

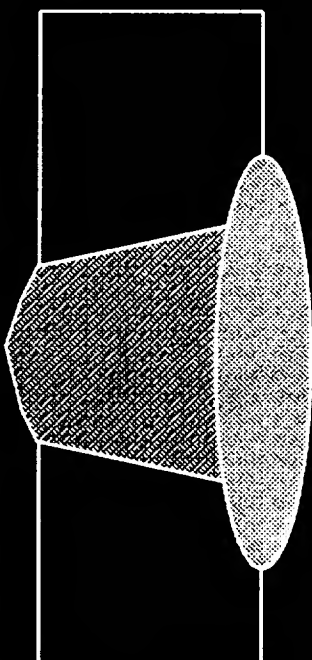
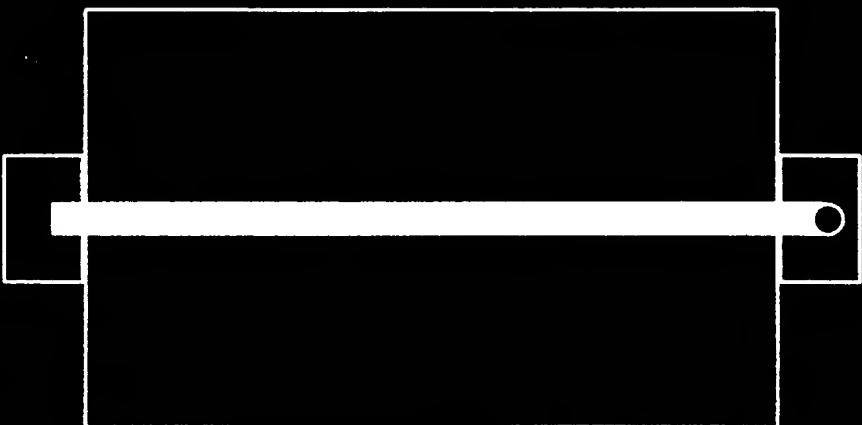


0.320" ± 2195 PLATE-TO-2195 PLATE

FILLER WIRE DEVELOPMENT FOR 2195 ALUMINUM-LITHIUM
FILLER WIRE CHEMISTRY DOWNSELECT

(3) Filler Wire Chemistries Cu, Ag, Zn, Mg, Ti, Zr

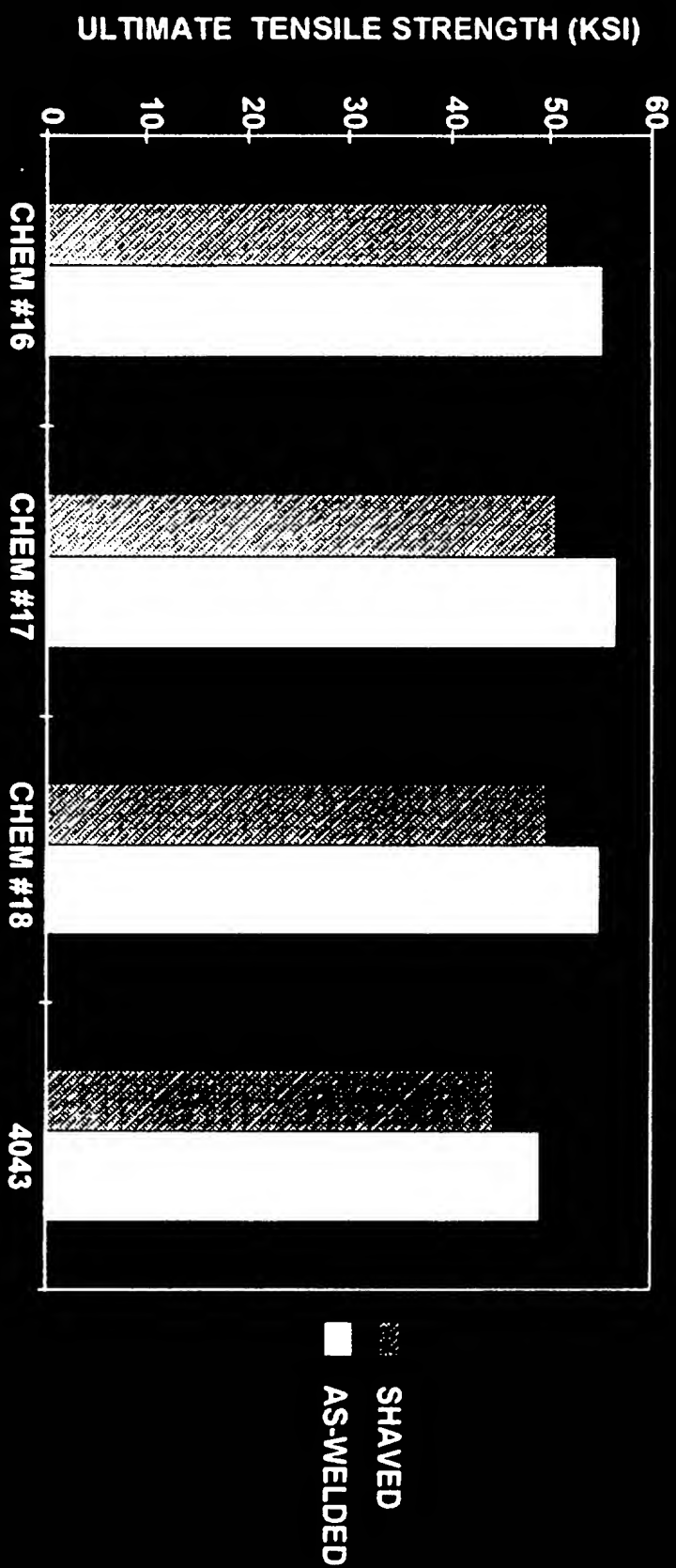
FILLER WIRE DEVELOPMENT FOR 2195 ALUMINUM-LITHIUM DOWNSELECT VPPA WELDING



- (2) 16" LONG TEST PANELS VPPA WELDED
 - (3) RT AS-WELDED TENSILES
 - (3) RT SHAVED TENSILES
 - (3) RT J1c CENTERLINE
 - (3) LN2 J1c CENTERLINE
 - (3) SCC
 - (6) MET. SAMPLES

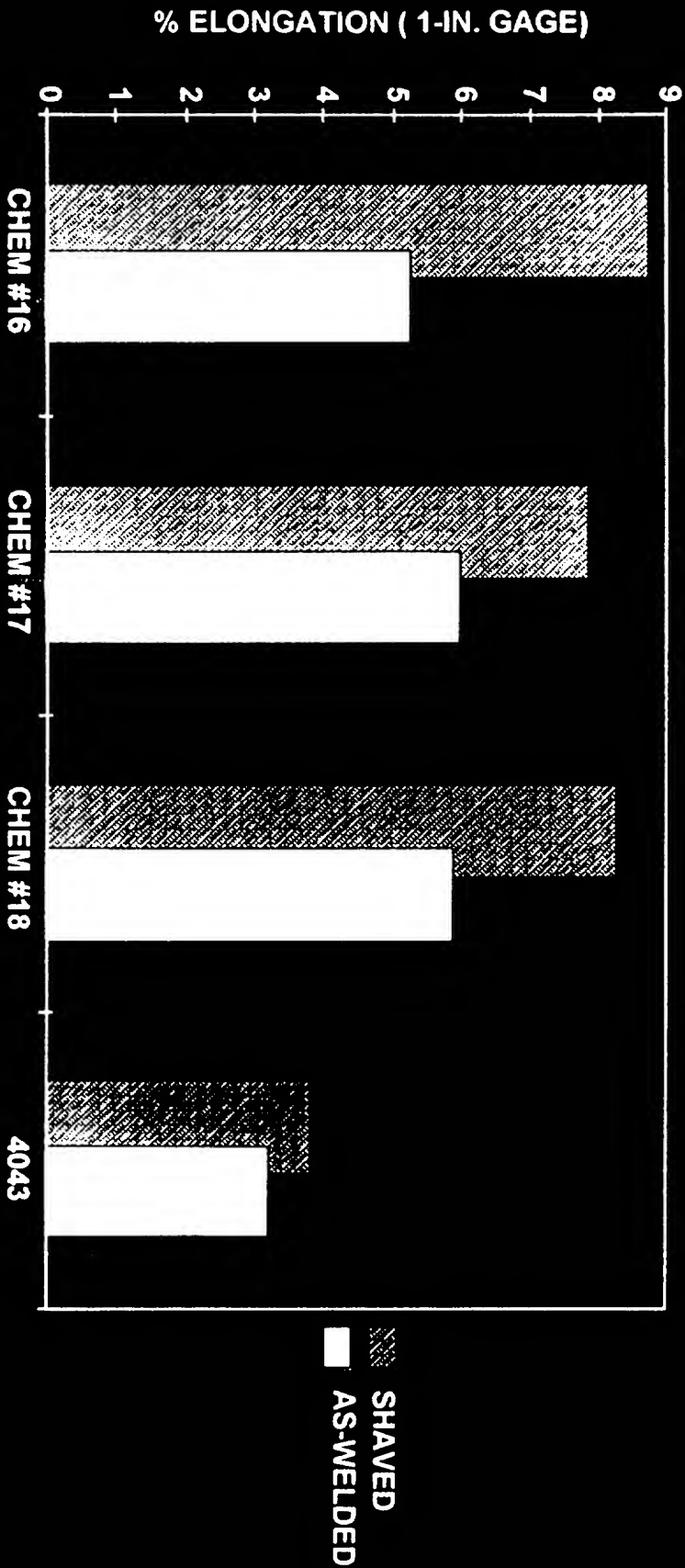
0.320"t 2195 PLATE-TO-2195 PLATE

FILLER WIRE DEVELOPMENT FOR 2195 ALUMINUM-LITHIUM DOWNSLECT VPWA WELDING WELD ULTIMATE TENSILE STRENGTH

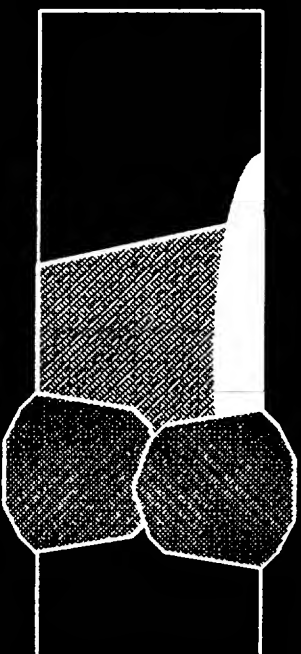
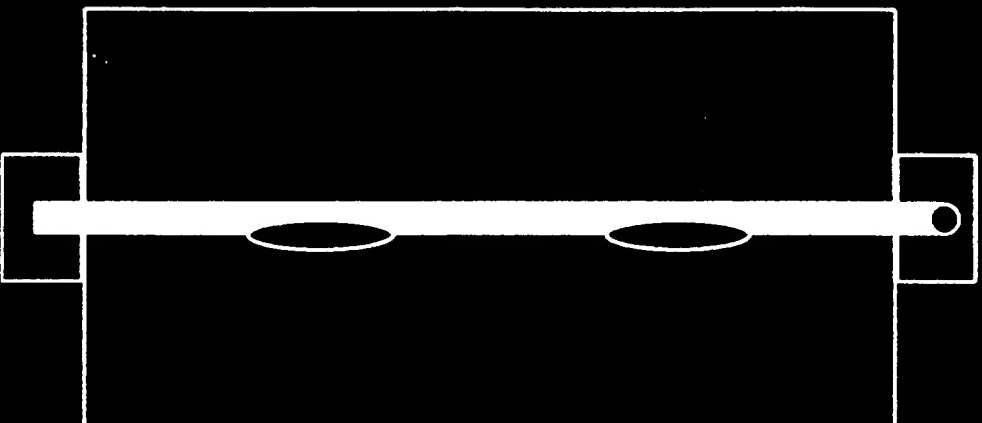




FILLER WIRE DEVELOPMENT FOR 2195 ALUMINUM-LITHIUM DOWNSLECT VPPA WELDING WELD ELONGATION



FILLER WIRE DEVELOPMENT FOR 2195 ALUMINUM-LITHIUM DOWNSELECT MANUAL GTA REPAIR WELDING



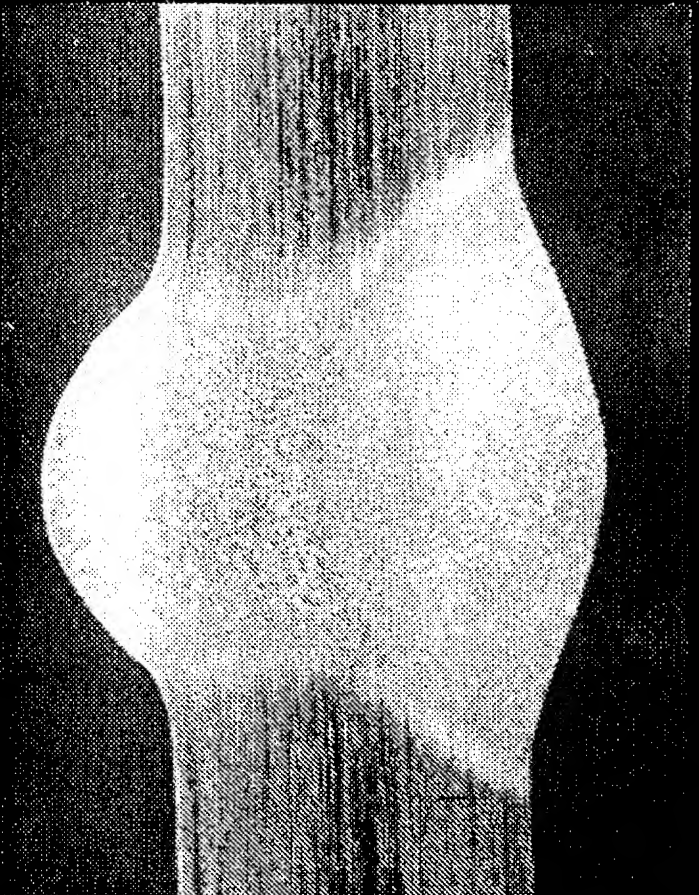
- (2) 24" LONG TEST PANELS VPPA WELDED
 - (4) RT SHAVED TENSILES
 - (4) LN2 SHAVED TENSILES
 - (3) RT J1c REPAIR FUSION LINE
 - (3) LN2 J1c REPAIR FUSION LINE
 - (3) RT J1c VPPA FUSION LINE
 - (3) LN2 J1c VPPA FUSION LINE

0.200"± 2195 PLATE-TO-2195 PLATE

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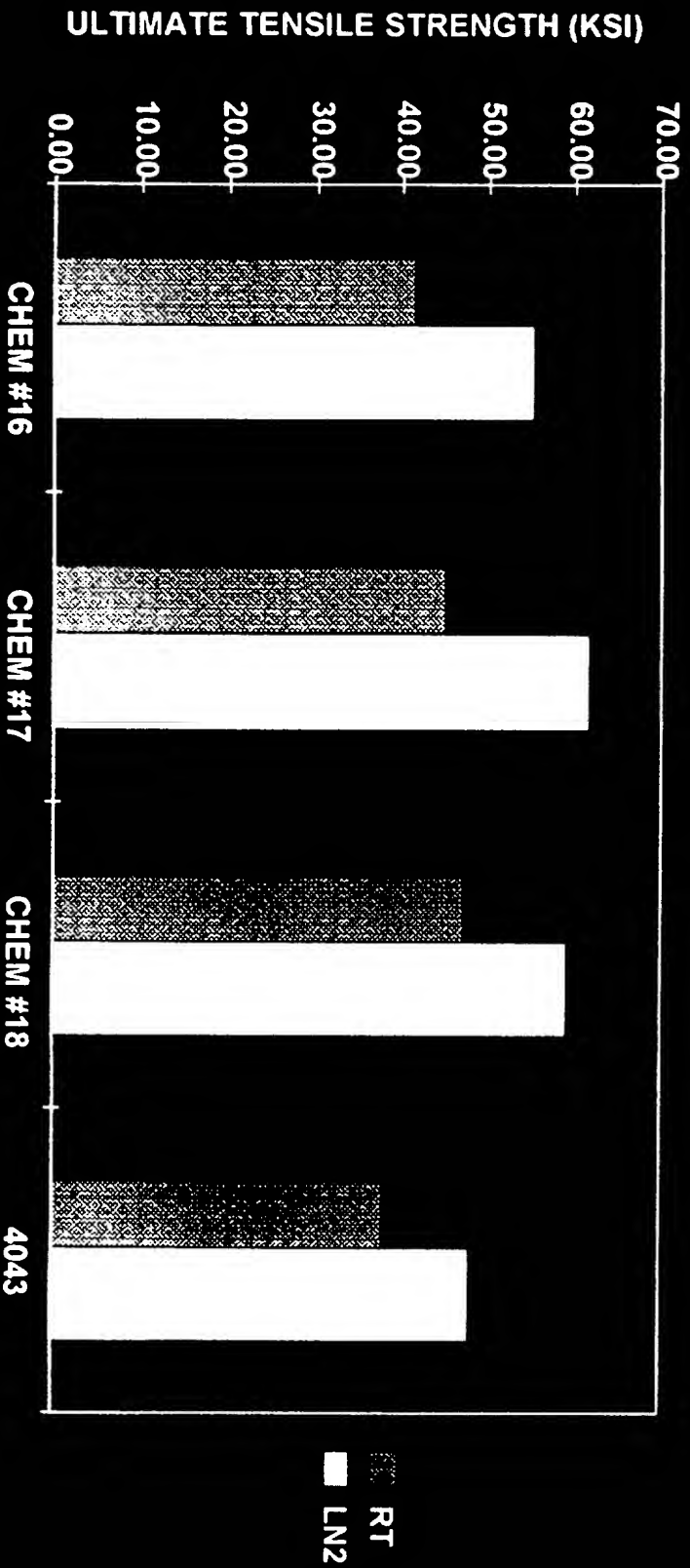
FILLER WIRE DEVELOPMENT FOR 2195 ALUMINUM-LITHIUM DOWNSELECT MANUAL GTA REPAIR WELDING



0.200"t 2195 PLATE-TO-2195 PLATE VPPA WELD

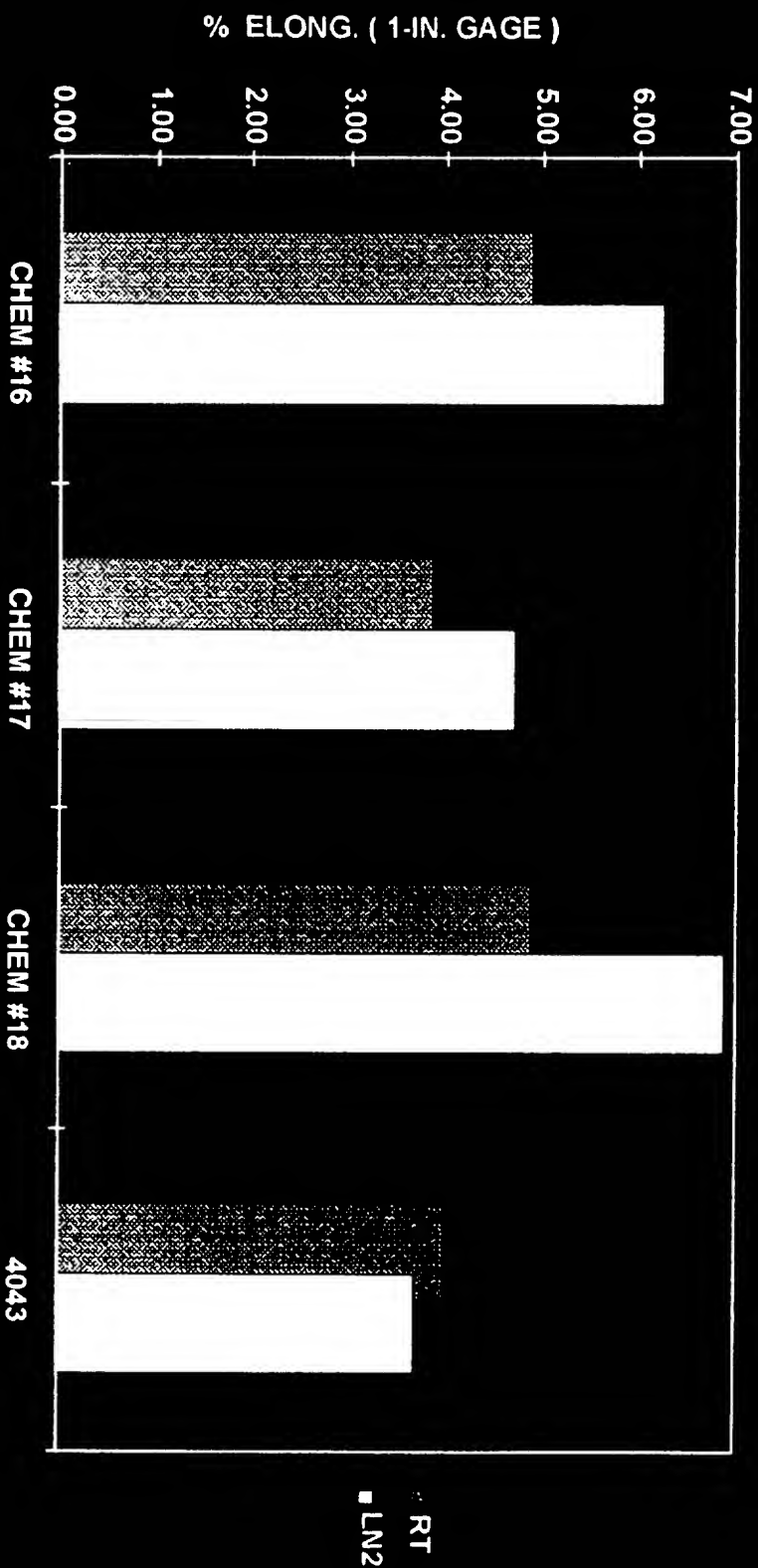


FILLER WIRE DEVELOPMENT FOR 2195 ALUMINUM-LITHIUM DOWNSELECT MANUAL GTA REPAIR WELDING REPAIR WELD ULTIMATE STRENGTH





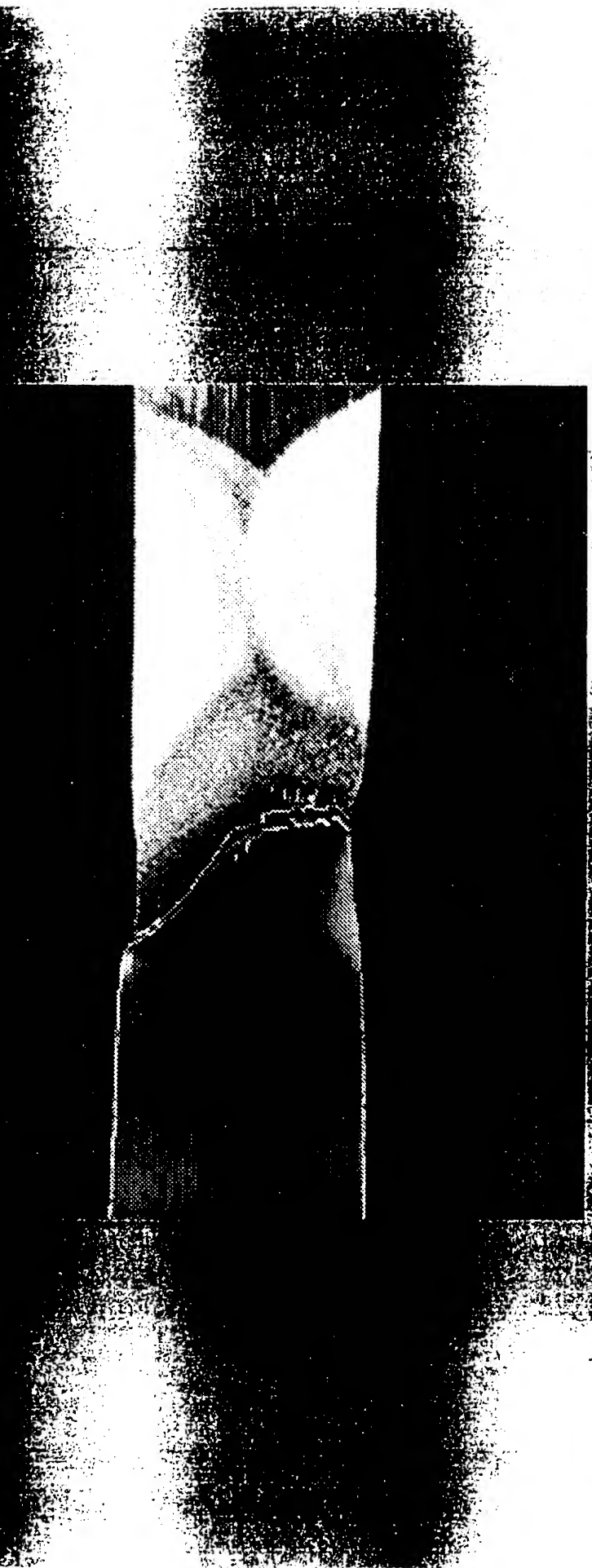
FILLER WIRE DEVELOPMENT FOR 2195 ALUMINUM-LITHIUM DOWNSELECT MANUAL GTA REPAIR WELDING REPAIR WELD ELONGATION





FILLER WIRE DEVELOPMENT FOR 2195 ALUMINUM-LITHIUM

DOWNSELECT MANUAL GTA REPAIR WELDING



0.200" t 2195 PLATE-TO-2195 PLATE R5 GTA REPAIR WELD



FILLER WIRE DEVELOPMENT FOR 2195 ALUMINUM-LITHIUM

FILLER WIRE CHEMISTRY

CONCLUSIONS

FILLER WIRE DEVELOPMENT FOR 2195 ALUMINUM-LITHIUM

OBJECTIVE

IDENTIFY AN Al-Cu BASED FILLER WIRE CHEMISTRY WHICH REDUCES WELD CRACK SUSCEPTIBILITY IN 2195 ALUMINUM-LITHIUM WELDS AND REPAIR WELDS ALONG WITH PROVIDING ADEQUATE MECHANICAL PROPERTIES.